

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Expanding Flexible Use of the)	GN Docket No. 18-122
3.7 to 4.2 GHz Band)	
)	
Expanding Flexible Use in Mid-Band)	GN Docket No. 17-183
Spectrum Between 3.7 and 24 GHz)	(Inquiry Terminated as to 3.7-4.2 GHz)

REPLY COMMENTS OF BASF CORPORATION

BASF Corporation (“BASF” or “we” or “our”) respectfully submits these reply comments in response to those comments submitted pursuant to the Notice of Proposed Rule Making, FCC 18-91, released July 13, 2018, in the above-captioned docket proceedings (the “Notice”).¹ The Notice sought comment on various proposals for transitioning all or part of the 3.7-4.2 GHz band (the “band”) for flexible use, terrestrial mobile applications, and it explores options for more efficient and intensive fixed use of the same band, all while protecting incumbent C-Band satellite earth stations from harmful interference. The Federal Communications Commission (FCC or the “Commission”) recognizes the incredible value of this band for both fixed and mobile broadband in the context of 5G and beyond.² Our reply comments are submitted so that the Commission recognizes the criticality of such 5G networks in ensuring the competitiveness of industrial manufacturing systems in the future and, therefore, secures sufficient spectrum in the band for private local networks to facilitate innovations in manufacturing and other flexible deployments of this mid-band spectrum.

¹ Order and Notice of Proposed Rulemaking, 83 Fed. Reg 44128, *et seq.*, (August 29, 2018).

² *Id.* at ¶ 5.

I. MOST COMMENTS TO THE NOTICE DID NOT ADDRESS INDUSTRIAL INNOVATION THAT IS CRITICAL TO FUTURE U.S. ECONOMIC GROWTH

The vast majority of the comments received by the Commission in response to the Notice are from those industries and companies seeking to maintain – or expand – their control of this band for their own purposes. Broadcast entities and Fixed Satellite Service (FSS) providers, which are dependent on the availability of full-arc-coverage downlinks to obtain feeds of programming which, at ground level, have low received signal levels, are only focused solely on their ability to retain the use of their receive-only C-Band antennas and with the absence of a practical alternative for reliable program delivery. The comments of the C-band receive-only antenna users note that the Commission has committed to protecting the incumbent C-band antennas, and accordingly oppose an auction-based approach to accommodating flexible use. Similarly, commercial mobile wireless service providers urge the use of competitive bidding for most or all of the spectrum between 3.7 and 4.2 GHz, and urge the clearing of the spectrum of incumbents, by negotiated settlements, reverse auctions or some other method. These commenters are more focused on usurping power over the band away from the FSS providers to ensure their own economic well-being.

Only one commenter, Robert Bosch LLC, together with several named, supporting parties (collectively, “Bosch”),³ advocated for the use of the band as a backbone to the implementation of localized, 5G private networks in support of next-generation manufacturing in the United States. Bosch noted that 5G implementation worldwide is proceeding at a rapid pace due to the benefit of 5G technology immediately available in numerous industry sectors to

³ Comments of Robert Bosch LLC and Supporting Parties, GN Docket Nos. 18-122, 17-183 (received October 29, 2018).

promote “Industry 4.0.” Industry 4.0 – sometimes called the “fourth industrial revolution” – is the digital transformation of industrial markets with smart manufacturing which is currently taking place in discrete and process manufacturing, logistics and supply chain, the chemical industry, energy, intelligent transportation, utilities, oil and gas, mining and metals and other segments, resources industries, healthcare, pharmaceuticals and even smart cities. Fundamental to this “fourth industrial revolution” is the implementation of a reliable communication layer capable of dealing with an increase of several orders of magnitude the number of assets, volume, variety of information and reaction times in future manufacturing systems.

A. How BASF Uses 5G Networks to Foster Innovation and Industrial Growth

BASF Corporation is part of the BASF Group, the world’s leading chemical company. With over \$61 billion in sales, six major “Verbund” or integrated complexes used in the production and marketing of chemicals and related products, close to 385 production sites, and over 115,000 employees, the BASF Group operates in more than 80 countries and serves customers and partners throughout the world. BASF’s parent company, BASF SE, is headquartered in Ludwigshafen, Germany. BASF Corporation is headquartered in Florham Park, New Jersey, is an indirect wholly-owned subsidiary of BASF SE, and is its largest affiliate. BASF Corporation currently holds FCC private radio licenses, which are used in BASF’s operations based in the United States.

Many applications in BASF’s production sites have requirements in the field of mobile communications and are dependent on a reliable and efficient digital infrastructure. In contrast to many American factories in the manufacturing industry, BASF’s production sites are typically sites that are more likely to be classified as regional applications. Our large-scale plants, such as petrochemical steam crackers that break down hydrocarbons into products such as ethene

(or ethylene) and propene (or propylene), are necessarily located outdoors and can be the size of small towns. The BASF “Verbund” production facility at Geismar, Louisiana, for example, encompasses 26 separate production facilities, contains 180 miles of pipelines, and covers 3.5 square miles, an area almost 4 times larger than the Pentagon. The key to managing these large sites in to ensure that production plants, energy flows, and logistics are intelligently networked to use resources as efficiently as possible.

In a specific example, BASF has been using mobile communications technology within these Verbund sites and other production sites for the operation of fully automated guided vehicles (AGVs) for the last year or more. Charging stations around the site will be supplied with new rail-optimized tank containers operated as AGVs. The logistics concept is an important part of BASF’s production and supply chain to ensure smooth and efficient operation. It is anticipated that these vehicles at one Verbund site will move 20 million metric tons of product per year. The AGVs are connected to a control station via an autonomous industrial radio network and are monitored in real-time by video stream. The communication link transmits control signals to the vehicle (e.g., to trigger an emergency stop in case there is the danger of an accident). The industrial radio network is operated as a campus network and is designed to meet the unique requirements of the AGV application so that an upload of 15 Mbit with a latency of <50 ms is available for each vehicle. To ensure operation, a bandwidth of at least 60 MHz is already required today; this bandwidth requirement on the availability and independence of the network result from the high-security needs of AGVs operating in open factory traffic.

During the preparation and implementation of this project, BASF worked with third-party network suppliers and mobile network operators to find a solution for the site. However, the

tendering process showed that none of the major mobile operators was able to offer a suitable technical and economic solution. Therefore, BASF was forced to implement an individual local network solution. This was required so that BASF could maintain the technological connectivity and, most importantly, keep up with its competition.

Other future fields of application in which the availability and use of suitable independent, network communication technologies will be the decisive success factor include the following:

- Use of Augmented Reality Applications, in which the operator of a production process or facility receives context-related information, which is displayed on the mobile device or portable computer depending on the situation and position, and which supports them in their work situation. This information can be data from various backend systems, evaluations, images, video information, and more.
- Assistance systems for mobile work, in which employees are supported by assistance systems that support them in working with expert knowledge, video, and audio connections, or artificial intelligence (AI) applications.
- Use of drones and robots, in which unmanned aerial vehicles (UAVs) or robots are used for maintenance and inspection tasks, or for complex or dangerous tasks in production plants under real-time requirements. Such UAVs or drones are controlled and monitored via mobile radio.
- IIoT (Industrial Internet of Things) applications, in which sensors monitor and control production processes. Chemical production plants today are typically equipped with approximately 3,000-5,000 sensors and actuators. Digitization is expected to result in the cost-effective installation of a large number of additional sensors for monitoring

and diagnostic tasks. At larger Verbund sites, BASF estimates that an additional 500,000 (or more) sensors could be employed, but only if the necessary communication infrastructure can be operated economically and reliably.

In short, without a mobile network providing a reliable communication layer capable of controlling and integrating modern manufacturing processes and equipment, not only could the competitive, Industry 4.0 factory of tomorrow not exist, BASF would be unable to effectively operate and compete in the international marketplace today.

B. Commercial Wireless Service Operators Cannot Meet BASF's 5G Needs

As demonstrated above when BASF was forced to develop its own network for its AGVs, industrial mobile radio applications in the chemical industry and other emerging and economically critical U.S. industries have technical and legal requirements which are not met by, and cannot be met by, the business models of commercial wireless service operators.

The core requirements for current and future 5G networks in terms of legally required operator responsibility and operational reliability are such factors as:

- adherence to maximum latency times;
- provision of higher minimum upload speeds; and
- compliance with the many legal and normative requirements such as those promulgated by the Environmental Protection Agency (EPA) or Food and Drug Administration (FDA).

In addition, flexibility, cost-effectiveness, and implementation speed are essential factors for successfully investing in IIoT innovations and thus being able to compete internationally.

In order to maintain our competitiveness both in the United States and internationally, BASF must be able to operate tailored, flexible, “own” 5G networks for communication between machines, systems, and plants at its production sites, independent of the commercial wireless service providers. This is the only way to ensure that we – as the responsible site operator – can control the quality of the 5G network, decide on the timing of any required network expansion or customization, and maintain data availability, confidentiality, and integrity.

II. RESERVING A PORTION OF THE BAND FOR PRIVATE NETWORKS MEETS OTHER CRITICAL NEEDS AS WELL

A. Harmonization with Other Countries’ Standards

As pointed out by Bosch in its comments, allocating a portion of the band in the United States for private networks would facilitate an exceptionally flexible opportunity for manufacturing in the United States to be harmonized with other parts of the world.

The German Federal Network Agency (*Bundesnetzagentur*) has adopted an innovative means of flexibly rolling out mid-band 5G spectrum in Germany. Under guidelines promulgated on November 26, 2018, the band 3.4-3.7 GHz will be allocated and assigned by auction to traditional mobile broadband providers. The 3.7-3.8 GHz segment, however, will be flexibly deployed locally by individual manufacturing and industrial entities. This local deployment by the private sector in Germany will be a key component in the rollout of 5G networks in support of Industry 4.0 initiatives in manufacturing and industrial applications in Germany, making German companies more competitive internationally. Furthermore, United Kingdom, Italy, and South Korea have already assigned spectrum in parts of the 3.5-4.2 GHz band as part of their

own, core 5G network development efforts.⁴ As a further example, China's regulatory authority has committed to release 100 megahertz of mid-band spectrum per operator, with a focus on 3.4-3.6 GHz.⁵

These countries are all motivated by the fact that mid-band spectrum is increasingly valuable as capacity spectrum for both fixed and mobile networks. In order to keep U.S. companies competitive in international markets, the Commission would be prudent to adopt a similar plan for the 3.7-4.2GHz band here in the United States.

B. Allocation of a Portion of the Band to Private Networks Ensures Safety and Security

As demonstrated in the section above on BASF's AGV initiative, constant, live-stream monitoring of production facilities, AGVs, UAVs, robots, sensors, and more ensures a safe and effective workplace which, in turn, ensures the safety and well-being of U.S. employees. While commercial mobile operators could not currently meet the technological needs of such systems (and show no signs of being able to do so in the future), a private 5G network was able to meet such requirements. Ensuring adequate bandwidth for such private networks in the future will be essential to workplace and worker safety in the generations to come.

⁴ See Sacha Kavanagh, 5G UK AUCTION, 5G.CO.UK (June 11, 2018), <https://5g.co.uk/guides/5g-uk-auction/>; Juan Pedro Tomás, ITALIAN GOVERNMENT RAISES \$7.5 BILLION IN 5G AUCTION, RCR Wireless News (Oct. 3, 2018), <https://www.rcrwireless.com/20181003/5g/italian-government-raises-billion-5g-auction>; MSIT ANNOUNCES RESULT OF 5G SPECTRUM AUCTION, TeleGeography (June 19, 2018), <https://www.telegeography.com/products/commsupdate/articles/2018/06/19/msit-announces-results-of-5g-spectrum-auction/>.

⁵ CTIA, *The Global Race to 5G*, at 8 (Apr. 2018), <https://api.ctia.org/wp-content/uploads/2018/-04/Race-to-5G-Report.pdf>;

Similarly, industrial security requirements are on the rise. Whether it is the internal needs of companies to be connected with their workers or the increased security requirements of federal and state agencies, manufacturers and other industrial processes are demanding ever greater private network capabilities. For example, in 2016 the Coast Guard promulgated new rules under the Maritime Transportation Security Act of 2002 (MTSA) calling for the use of Transportation Worker Identification Credential (TWIC) biometric readers at numerous industrial sites around the country.⁶ To securely link these readers at a 3.5 sq. mi. facility such as BASF's Geismar Verbund site, a strong, capable and technologically advanced private network is needed. As U.S. defense and security agencies increase their focus on industrial security in the coming years, the need for private, reliable 5G networks will only increase. Thus, it is essential that the Commission allocate adequate bandwidth for such networks.

III. CONCLUSION

For all of the above reasons, BASF is in support of the comments of Bosch and is of the view that the authorization of private 5G local networks in the band segment 3.7-3.8 GHz is an urgent component to the Commission's proper focus on timely rollout of 5G mobile and fixed operation in the 3.7-4.2 GHz band. The availability of these private local networks constitutes a highly flexible and preferential means of allocation of radio service throughout the United States pursuant to the Commission's statutory obligation in that respect.⁷ The future competitiveness and success of American industry is dependent on the integration of 5G network technology at

⁶ Transportation Worker Identification Credential (TWIC)-Reader Requirements, 81 Fed. Reg. 57,651 (August 23, 2016).

⁷ 47 U.S.C. § 307(b).

the local level.

Therefore, the foregoing considered, BASF respectfully requests that the Commission make 5G network technology available on a flexible basis in the band 3.7-3.8 GHz for use in industrial applications as described in these reply comments.

Respectfully submitted,

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